

MASTER'S IN COMPUTER SCIENCE

MSIT3820- BUSINESS INTELLIGENCE PROJECT FIRST DRAFT



COMPANY NAME: Toast, Inc.

GROUP NUMBER: 2

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I) EXECUTIVE SUMMARY:

Toast, Inc. is an IT software company (cloud-based restaurant management software) that is situated in Boston, MA. The Android OS acts as the prime POS (point of sale) system for the organization. The company was set up in 2013 as their initial POS software where customers could place the order kitchen and get back the update only. As it was the early setup, it had only minimum components where they could not apply data visualization. Slowly, they moved towards improvising their software. According to MIT research in 2019, Toast Inc. ranked third fastest-growing technology company as they reported 30,000 percent from 2013 through 2016. However, their tool became a dated POS system they faced the following challenges.

II) PROBLEMS STATEMENT:

Toast's rapid growth and profitability lacked a comprehensive understanding of the driving factors, such as customer orders, menu item performance, and employee efficiency. This knowledge gap hindered their ability to make informed decisions. The company struggled with benchmarking itself against industry competitors, lacking insights into how they compared within the restaurant tech sector. This shortage of competitive analysis puts them at a strategic disadvantage. They began utilizing Incorta in 2017 to visualize and examine their data. This made their new data warehouse more cost-effective than other solutions they were using, especially as their databases increased and elements changed. It also helped them merge their previous data warehouse with the new one. Another issue restricted their dependence on inherited tools, including Incorta, Stitch, Airflow, Snowflake, and Looker. While these tools initially facilitated their centralized system, the COVID-19 pandemic exposed vulnerabilities and limitations in this infrastructure, prompting a need for greater resilience and adaptability.

Operational efficiency was also a concern, as Toast was required to identify areas for improvement. These areas include optimizing pricing strategies, streamlining operations, and expanding their customer base, all of which were difficult to identify without data-driven insights. The main challenge was in making strategic decisions for the company's future. BI tools will provide Toast with the data-driven insights it needs to understand its success, evaluate its competition, and enhance its business operations. This revolutionary change will enable it to achieve long-term growth and profitability in the dynamic restaurant tech sector, enhance its offerings, and adjust to changing market conditions.

III) CAUSES OF THE PROBLEM:

Toast had several obstacles in effectively overseeing its restaurant's technological operations. Data sharding and the first problem involves dividing their database into smaller components, which impedes a comprehensive view of activities. Database administrators are aware of this fragmentation, which can make it difficult to evaluate and make decisions due to the fragmented data. The absence of real-time insights was a hurdle for Toast, impeding its ability to promptly adjust to the changes in the business environment. This issue can be related to real-time processing theories, emphasizing the importance of up-to-date information for agile decision-making. The third issue that impacted service quality was not having data on customer preferences. The importance of comprehending and satisfying client preferences for overall corporate performance is emphasized by customer relationship management theories, which are in line with this topic.

However, after Business Intelligence (BI) tools were implemented, Toast experienced a major transformation. By integrating data, providing real-time analytics, and giving an in-depth knowledge of client preferences and kitchen efficiency, BI offered a centralized platform that addressed these issues. This change is consistent with BI theories and emphasizes the value of data-driven decision-making for both overall business performance and operational development.

IV) DECISION CRITERIA AND ALTERNATIVE SOLUTIONS:

Making operations run smoothly, controlling expenses, making it simple for employees to manage, and obtaining real-time information are the primary factors that restaurants should consider when determining a solution. Ease of integration with everyday tasks, affordability, staff usability for non-technical staff, and fast and current information for decision-making in a massive production work environment are key factors for the solution. Receiving quality service is the most important thing to customers. The system of choice ought to speed up order processing and provide customized services based on up-to-date data. Restaurants that use technology to provide individualized service, quick adaptation to changing needs, and improved service quality are likely to develop a loyal customer base that talks about their experiences.

When Toast Inc. selects a solution, they make sure it effectively addresses their issues. They consider how easy it is to put up with it, how much it will cost, if the management team approves, and whether it can bring about significant improvements. As a restaurant technology supplier, Toast Inc. seeks solutions that meet the various needs of its customers to stay competitive in the tech sector as well as for everyday chores. To ensure the long-term success of Toast Inc. and the restaurants they support, they also consider if the solution is safe, scalable, and originates from a reputable business.

ALTERNATIVE SOLUTIONS:

Any type of Toast data, regardless of format or organization, can be stored in a data lake. By doing this, Toast would be able to view all its data, solving the issue of data sharding. To solve the issue of lacking real-time insights, real-time data can also be stored in data lakes. Next, A central store for collected and cleaned structured data is called a data warehouse. This would make Toast's data easier to analyze by enabling it to be seen in a clear and organized manner. To solve the issue of lacking real-time insights, real-time data can also be stored in data warehouses. Finally, A hybrid solution would incorporate both a data warehouse and a data lake. By doing this, Toast would be able to benefit from both options. All of Toast's data might be kept in the data lake, and the data that is most crucial for analysis may be kept in the data warehouse.

PROS AND CONS:

1) DATA SHARDING:

Pros: Toast can benefit from implementing a data lake in several ways. First, it can overcome format and structure limitations to provide an all-inclusive storage solution for all data. By addressing the issue of data sharding, this approach offers a comprehensive perspective on the data. Furthermore, real-time data can be stored in data lakes, guaranteeing Toast instant access to the most recent information. Furthermore, it is a financially appealing alternative due to its relative cost-effectiveness.

Cons: One significant disadvantage, though, is the complexity of giving a data lake. Implementing and maintaining such a system requires close supervision. Depending on the complexity of the necessary studies, there may be difficulties in querying data from a data lake and limitations in its applicability for specific analytical activities.

2) GETTING REAL-TIME INSIGHTS:

Pros: Maintaining clean, well-organized data is one benefit of implementing a data warehouse. It makes analysis simpler by offering an organized setting for effective data processing. Decision-making processes are improved by the ability to hold real-time data, which meets the requirement for rapid insights.

Cons: A data warehouse's setup and maintenance expenses could be greater. Its applicability to specific types of data and analysis may be limited by its possible lack of flexibility when compared to a data lake. Additionally, depending on volume and diversity, there might not be enough room to store all of Toast's data.

SUGGESTED PROS AND CONS:

Vendor Reputation: It matters a lot who Toast chooses to provide their solution to. Going with a reputable and well-known business is like having a trustworthy buddy because they provide the reliability and assistance that keeps everything going smoothly. But it may be as random as rolling the dice if they choose a lesser-known business. There may be concerns about the quality of the service and their long-term viability.

Scalability: Toast must consider whether the solution will be able to expand along with them. Having a solution that can grow with Toast is like having a wardrobe that fits you perfectly no matter how big it becomes. However, the solution is like a backpack that is unable to hold everything if it is unable to manage expansion.

Security: Ensuring the security of Toast's information is crucial. When a solution has excellent security, all of Toast's data is protected by a powerful fortress. It ensures that all the crucial information is secure and keeps out any bad guys who might try to break in. However, inadequate security is like having a door without a lock.

There's a possibility that some unsavory visitors may enter, which could provide issues for Toast. So, Toast, just make sure the solution suits your growth goals, is dependable, and maintains a solid defense against any digital issues.

V) RECOMMENDED SOLUTIONS, IMPLEMENTATION, AND JUSTIFICATION:

Solution is to develop a strong business intelligence system, improving visualization, and using the right graphs for thorough insights to address Toast's data analysis issues. Assign accountability to data analysts, start the implementation right away, and carry out frequent evaluations. By addressing recognized issues and fostering data-driven decision-making and operational enhancements, BI solutions guarantee long-term success.

DATA ANALYSIS METHODS AND RESULTS:

The data analysis methods utilized a combination of visualization and metrics to explore several key aspects:

Total number of Restaurants: This analysis shows the total number of Restaurants in Toast is 20, and the count distinct method to show the number of restaurants associated with Toast.

Total number of Cuisines: This analysis depicts the total number of Cuisines in Restaurants as 8 and the count distinct method to show the number of cuisines in restaurants is associated with Toast.

Peak Order Analysis: This insight reveals the trend of visits to restaurants during the new year 2022. We have used a bar chart to visualize the trend, focusing on the visits to restaurants based on timings(hours based). The analysis utilizes the sum of order amounts, broken down by restaurant and order date hour, to understand the distribution and trends in purchasing behavior. We applied a filter for both Category and Hours(Order Date), the data is filtered the category-based

restaurants and choose between Pro and Ordinary. From these visuals, we see that the Peak hour 11'Clock with Willie's restaurant topping the list whereas the base hours are 19'clock Oslo restaurant ranking at the bottom of the list. Also, we have used annotate to emphasize the top and base hours for a clear interpretation of the data.

Customer Ratings Based on Delivery: We have used a tree map to illustrate the customer rating by delivery during the New Year 2022. Using these fields Restaurant Name and Average Customer Rating-Delivery it effectively represents the average customer ratings, providing insights into the performance of each restaurant. From this visual, it is clear that The Cave Hotel emerges as the top performer with a notable rating of 3.50, while Denver Restaurant lags with the lowest rating of 2.48. We used color to differentiate the average of Customer Rating-Delivery. The marks are labeled by Restaurant Name and Average of Customer Rating-Delivery.

Customer Ratings Based on Food: We have used a table chart and Custom Star Rating to show the count of customer ratings for food. We present the count of customer ratings based on food from a data analyst's viewpoint. The calculated field transforms numerical ratings into a visual representation using star icons, with the top row symbolizing a 5-star rating indicative of customers with the maximum rating for that cuisine, the rating also includes 4-star, 3-star, 2-star, and 1-star ratings for customer preferences of rating the food choice.

From this insight, it shows that the most highly rated popular cuisines are Chinese and North Indian, followed by African and South Indian. The predominant star rating is 5 stars, followed by 4 and 3 stars. Also, the table shows that the cuisine with the highest average rating is Chinese, followed by North Indian and African. The cuisine with the lowest average rating is Continental, followed by Arabian. We used labels to display the count. Evaluating customer ratings related to food choice across different restaurants and cuisines, providing insights into customer

satisfaction and preferences.

XENOGRAPHIC:

Comprehending the connections among sets is a crucial analytical undertaking. If the number of sets is beyond a minor threshold, the main problem in this situation is the combinatorial explosion of the number of set intersections. Venn Diagrams, the most widely used set visualization technique, only work with three or four sets. On the other hand, UpSet works effectively for quantitative analysis of data that consists of more than three sets. Here we, have used three graphs to represent the upset plot they are explained in detail below. The column which I have used here is Cuisine and Zone.

Total number of Cuisine as per Intersected Zone: A bar graph has been used to represent the number of cuisines occurring in each zone or intersecting zone. The results show Zone D and Zone B together have 5 cuisines in common. A calculated field to count the number of cuisines per intersected zone is been created by using COUNT(). Zone parameter is created and each zone is added to it and stored. 3 calculated field is created to include the formula for each zone, the formula includes FIXED LOD, MAX(), and IF...ELSE(). Another calculated field to insert the intersections using IF...ELSE(). Hence, the results produce an output with correspondence to the DottedPlot. In the row and column we place the Zone list and aggregated number of cuisines as per intersected zone respectively. To differentiate the color 'Color concat' calculated field is created so that we can dynamically select the values in the dashboard to change accordingly.

Total number of Cuisine per Zone: This is a simple bar chart where we drag the previously created calculated field number of cuisines as per intersected zone in a row to get the count value and zone in the column. Another color is being created to give colors for the selected values dynamically in the dashboard.

DottedPlot - Intersected Zone & Cuisines: A dual axis chart using circle and line graphs is created where the line shows the relationship or link and the circle indicates the zone where it is available. An index is created as a calculated field to create the dual axis and calculation to merge the zones with cuisines.

List of Cuisine per Zone: Here all the cuisines and zones are listed in a table chart. Totals are calculated by dragging the analytics- totals into the list, and a column-wise total has been created.

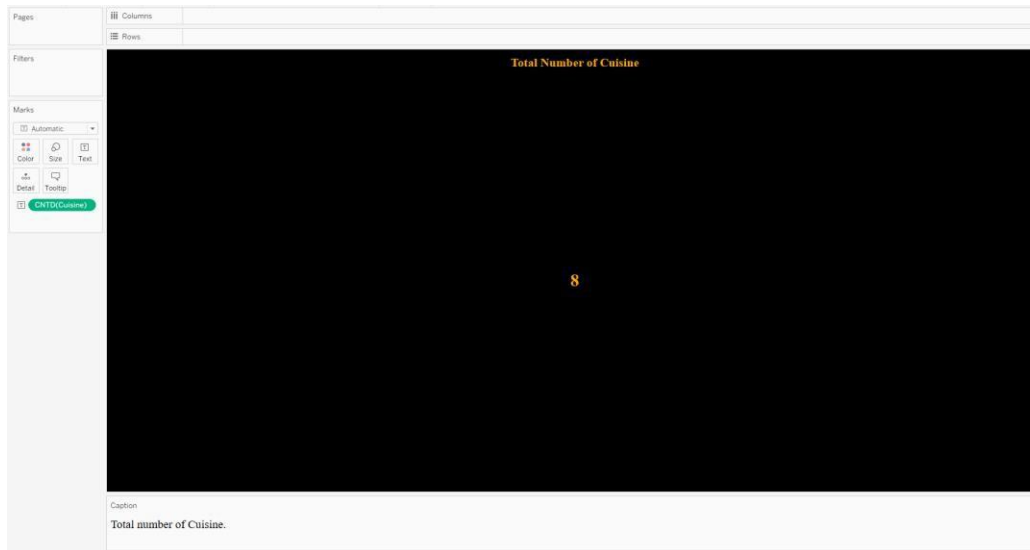
Also, zone can be seen separately as the Zone dimension is placed in the filter. We used zone and cuisine in column and row respectively.

IMPLEMENTATION: DATA VISUALIZATION EXAMPLES (INCLUDE SCREENSHOTS):

1) Total number of Restaurants: This analysis shows the total number of Restaurants in Toast is 20, and the count distinct method to show the number of restaurants associated with Toast.

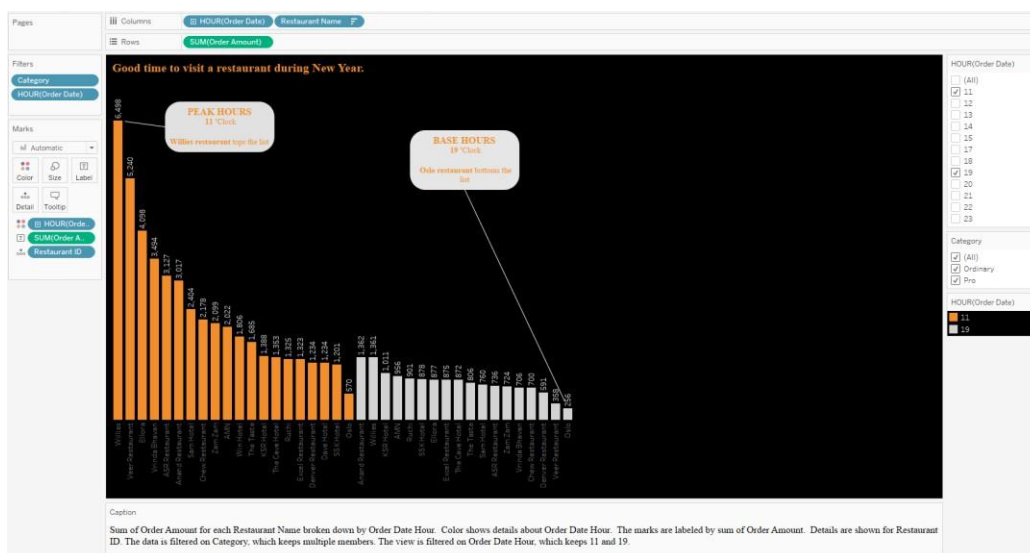


2) Total number of Cuisines: This analysis depicts the total number of Cuisines in Restaurants as 8 and the count distinct method to show the number of cuisines in restaurants is associated with Toast.



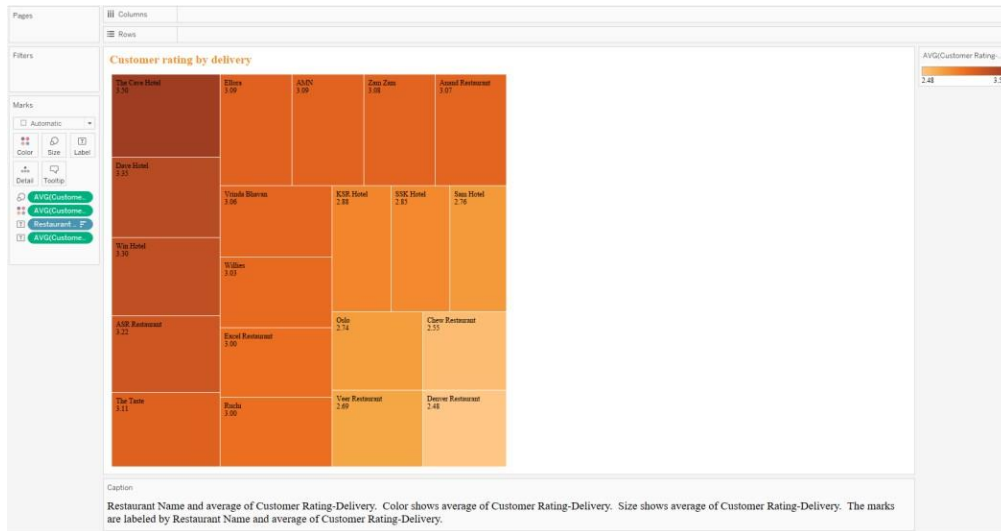
3) Peak Hours Analysis:

We have used a bar chart to display the peak hours on the New Year.



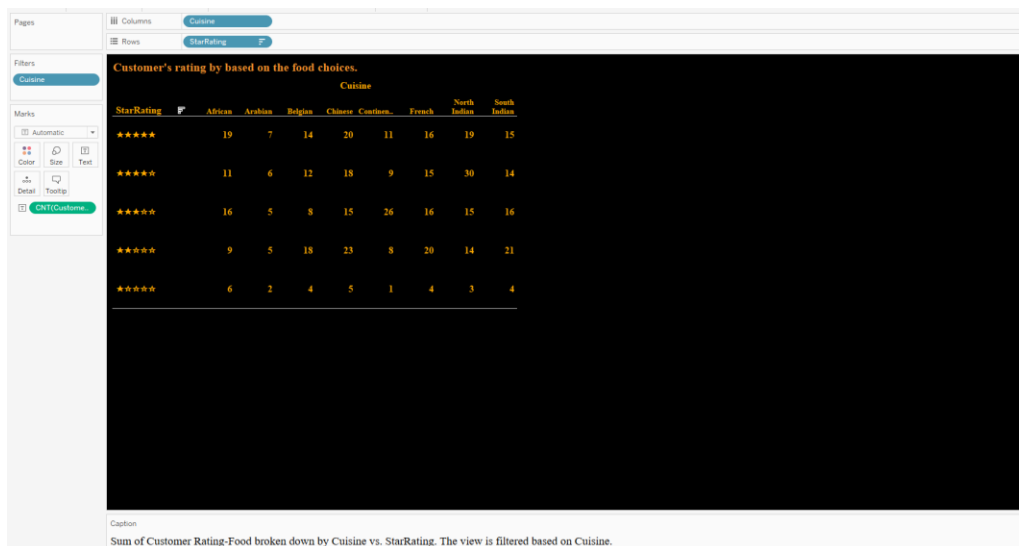
4) Customer-Rating based on delivery:

We have used Tree map to display the customer rating based on the delivery.



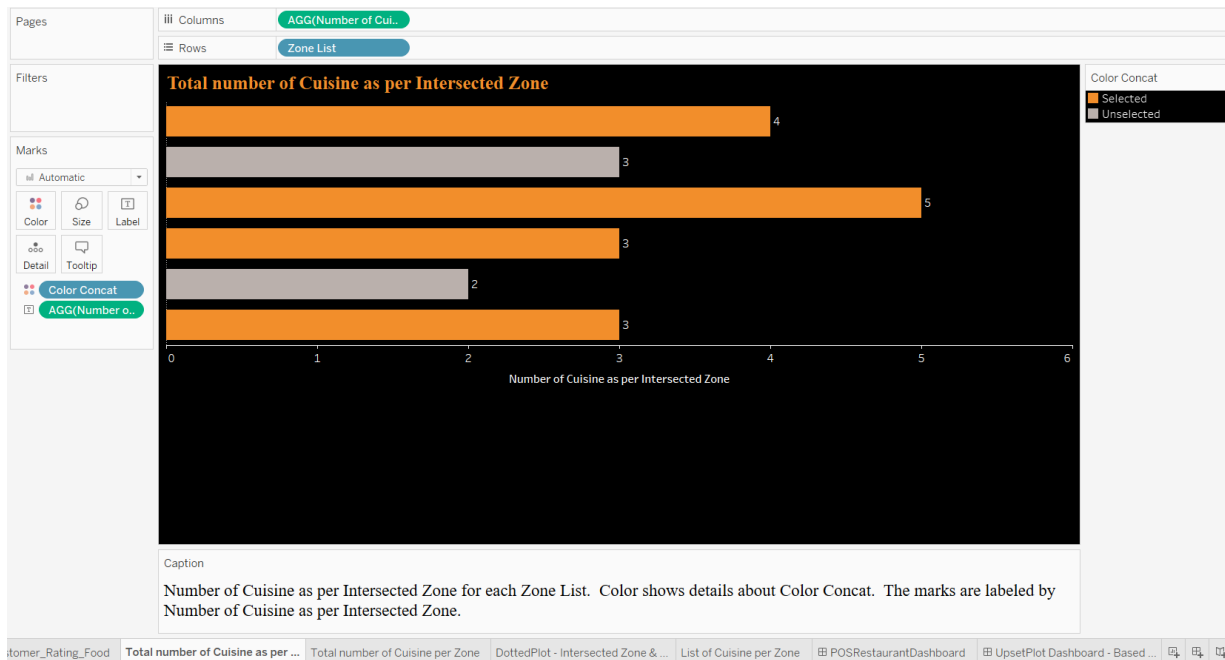
5) Customer- Rating based on Cusines

We have used a table chart to display customer ratings based on Cusines, for displaying the star ratings we have used a calculation field for inserting the star symbols.



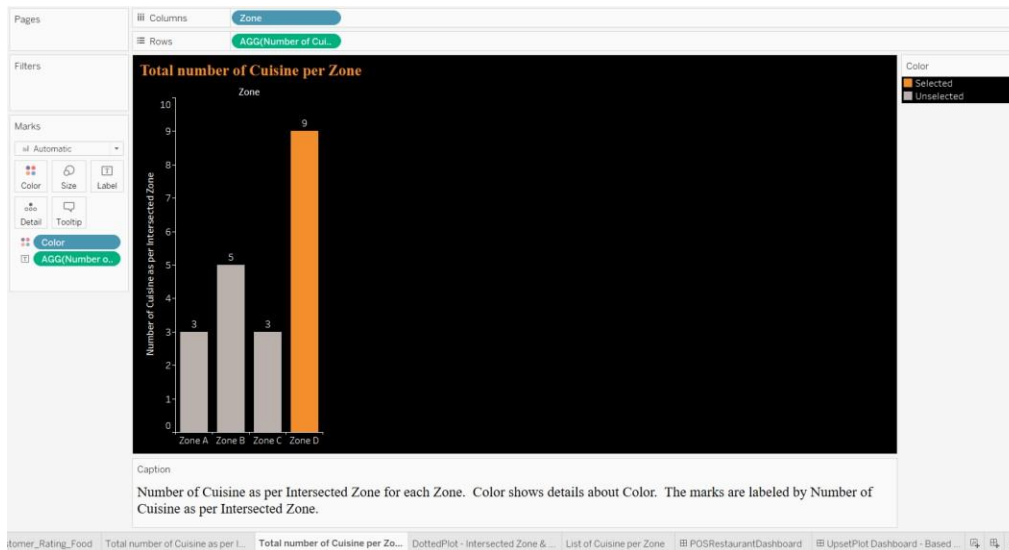
6) Total number of Cuisine as per Intersected Zone:

Here, bar graph is used to represent the number of Cuisine as per Intersected Zone.



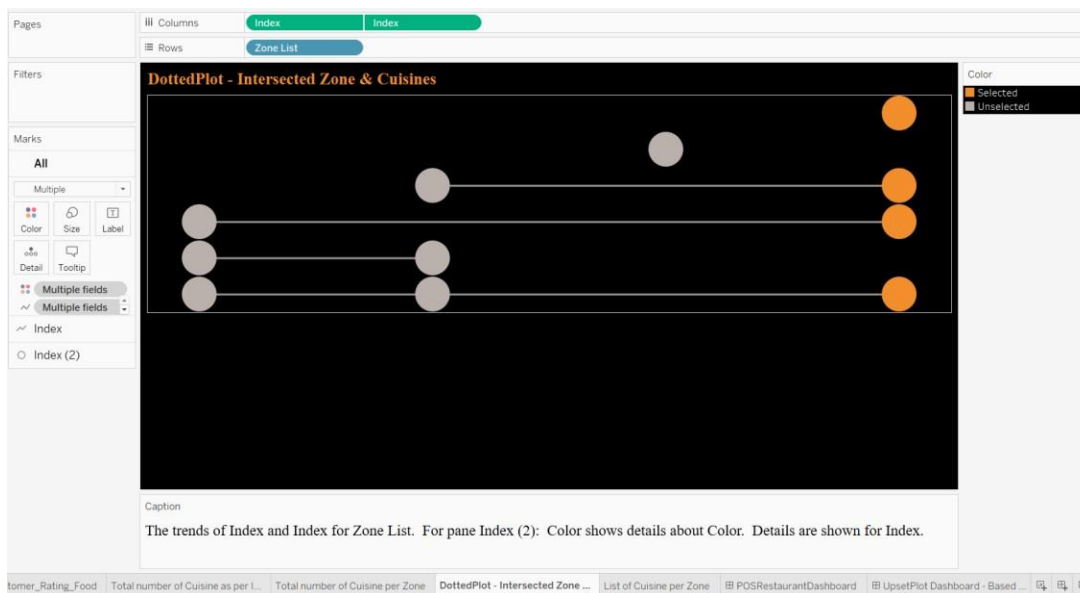
7) Total number of Cuisine per Zone:

A vertical bar chart is used to calculate the total number of zone which is categorized based on cuisines.



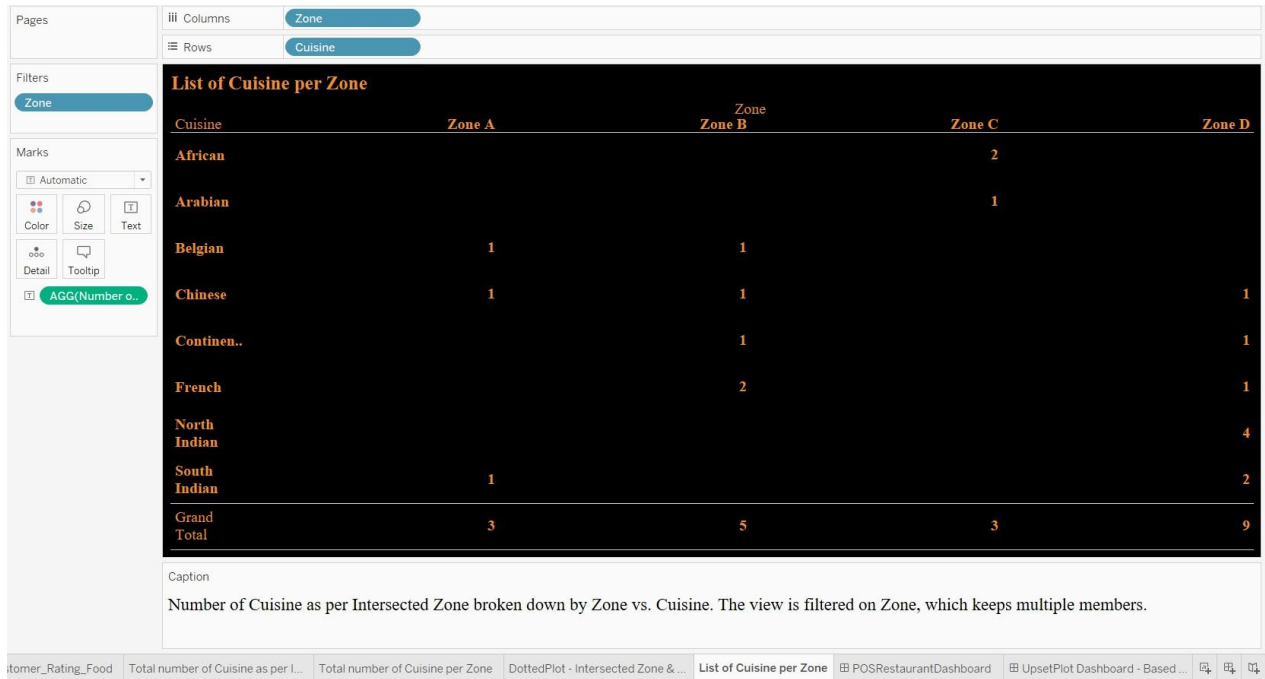
8)DottedPlot - Intersected Zone & Cuisines:

A line and circle chart is combined using Dual Axis and displayed those dots indicate the zones and lines link the relationship between the cuisines and zones.



9)List of Cuisine per Zone:

A list of cuisine and zone separately are portrayed with the column grand totals to see the top zone.



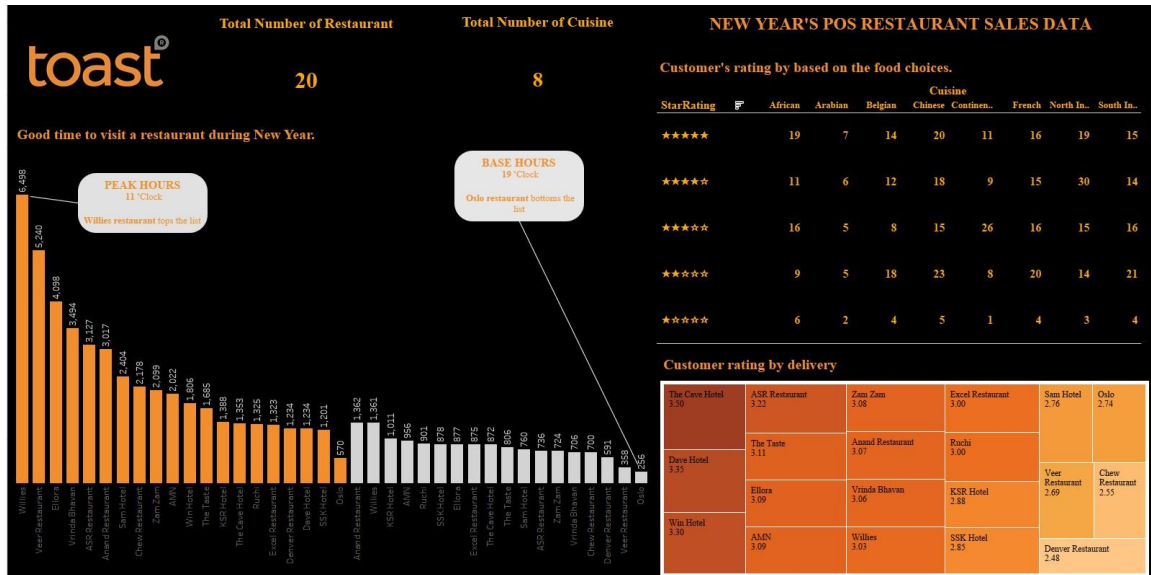
JUSTIFICATION: POSRestaurantDashboard:

Key findings from the analyses,

- The total number of Restaurants in Toast is 20.
- The total number of Cuisines in Restaurants is 8.
- A logo for Toast is created, and clicking the logo will direct the users to the official page of Toast Inc.
- Peak hours for restaurant visitation during the New Year are observed at 11 o'clock and the base hours are at 7 o'clock in the evening which is clearly annotated in the visual.
- Willies and Oslo are the best and least restaurant preferences based on their sales.
- Chinese foods are most preferred based on customer rating and Continental food is rated

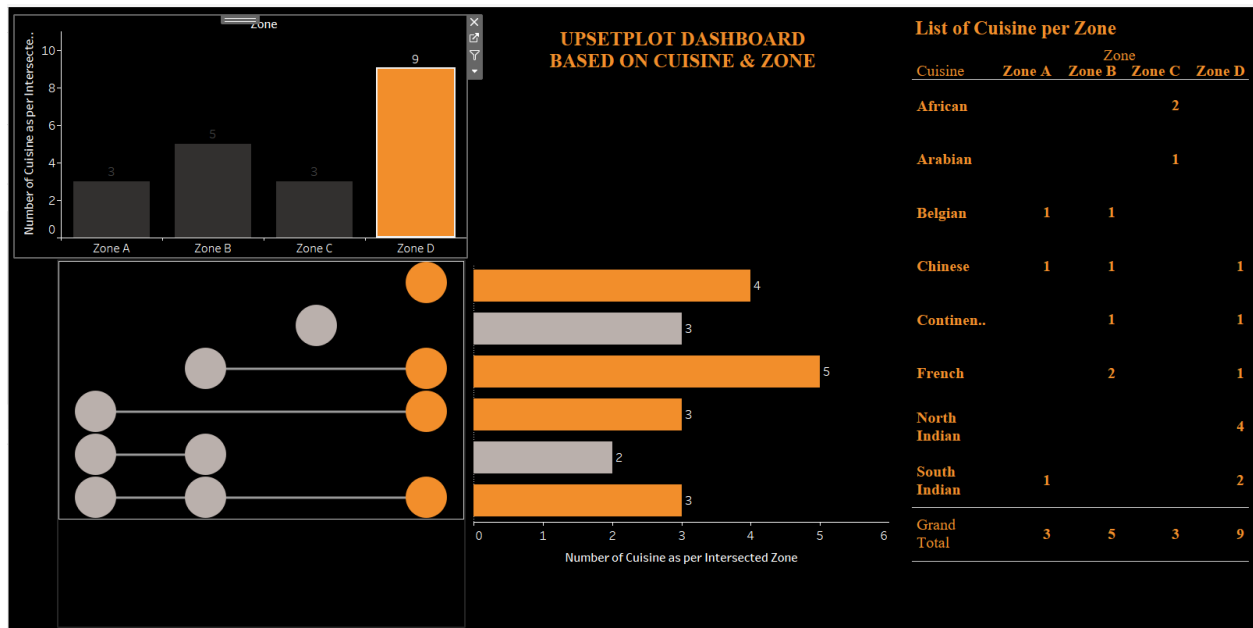
very low by the customer.

- People prefer The Cave restaurant for delivery as their services top the list.



UpsetPlot Dashboard - Based on Cuisine & Zone:

- Key findings from the analyses,
- Zone D has more cuisine.
- Each cuisine can be identified and pointed according to the zone.
- Zone D and B combined together and produced the highest result where people could go and have a maximum number of options on basis of cuisines, vice versa for Zone A and B with least number of results.



VI) ADDITIONAL QUESTIONS:

1) What are some of the problems that the company has?

A major hurdle to making well-informed decisions was Toast's inability to comprehend important business drivers including personnel productivity, menu performance, and consumer orders. The company was at a strategic disadvantage as a result of its difficulties benchmarking against rivals in the restaurant IT industry. Adaptability was further restricted by operational inefficiencies, such as data dividing and a lack of real-time insights. These challenges emphasized the need for an infrastructure that is more flexible and resilient, which may be achieved by implementing business intelligence (BI) tools for thorough data analysis and well-informed strategic decision-making.

2) What are the company's overall goals?

The Company's main objective is to sustain its rapid growth in the restaurant tech industry while ensuring that this growth is sustainable over the long term. By utilizing BI tools, Toast plans to divide the data generated by their cloud-based Point-of-Sale system to gain insights into the

drivers of their success, enabling them to replicate effective strategies and maintain their growth path. Customer satisfaction and dining experience improvement are core elements of their mission. Toast's goal is to use the data they collect to understand customer preferences, refine menu items, and enhance the overall experience. This involves customizing their offerings to better meet customer expectations and demands.

Competitive positioning is also a key aim, as they aspire to be a major player in the startup restaurant tech industry. With BI tools, Toast intends to benchmark itself against industry competitors, allowing them to fine-tune strategies, services, and offerings for a stronger market presence. Operational excellence is another priority. Toast seeks to enhance efficiency through BI, optimizing aspects such as pricing strategies and internal operations to ensure smoother and more cost-effective processes. The company aims to foster innovation and adaptability. The data-driven insights provided by BI will serve as the foundation for generating fresh ideas, improving existing processes, and making strategic decisions to guide the company toward a successful and dynamic future.

Additionally, the Toast company's main objectives are to offer a wide variety of food alternatives on the Toast platform, to optimize restaurant operations by analyzing order trends during peak hours, and to prioritize customer pleasure by analyzing ratings for popular food selections. There also appears to be an intentional focus on improving the dining experience for diners in particular location-based zones. This implies a complex approach that includes operational effectiveness, variety, and a deep awareness of consumer tastes in various settings in order to craft an effective and fulfilling dining experience for customers.

3) How could Business Intelligence help the company to solve the problems?

AND

4) What software does the company utilize?

Through analyzing the data from various business systems, including cash registers, online orders, and customer feedback, business intelligence (BI) tools Microsoft PowerBI help Toast organizations improve efficiency. This enables Toast to learn about customer preferences, peak hours, and cuisines. Based on the insights, Toast can forecast busy hours and predict the demand for special food items thus it helps in reducing food, making inventory management efficient. Additionally, the customer-rating and delivery preferences made possible by BI, using this data create unique marketing and loyalty offers.

After making the changes based on BI data, Toast emerged as a leading and competitive player in the restaurant industry and successfully tackled all the challenges, thus resulting in more profit and satisfying the customer through utilizing the data drive insights.

5) What are the logical components of the star schema? Or, if they do not have a Business Intelligence system in place, what would the components be in order to analyze data that is useful in solving the problems?

- The **Sales Fact** assists in tracking sales and profit that they make, and all the dimension table attributes are linked as references.
- The dimension tables provide context and additional information about the data in the fact table. For example, the **Time Dimension** helps analyze sales trends during different times of the day, days of the week, and seasons. The **Menu Items Dimension** allows you to understand which dishes are popular, special foods, the expiration check and the ingredients used. The **Customer Dimension** helps understand customer preferences and

loyalty. The **Restaurant Dimension** table will contain the restaurant details such as restaurant name, location, and contact information. The **Order dimension** helps to visualize wait time for the customer for the food to get ready and store the feedback from them.

- By arranging the data in a star schema like this, it will be helpful to effectively examine the operations, sales, and consumer preferences of the restaurant and make data-driven decisions to improve both the performance and happiness of the patrons.

The following are the possible components and attributes that could be used to visualize the data in solving the problems.

Fact Table:

Sales Dimension

- Attributes: Sales Order Number, Date and Time, Customer ID, Product ID, Quantity Sold, Unit Price, Total Price, Discounts and Promotions, Tax Amount, Payment Method, Location or Store ID Payment Status, and Order Status

Dimension Tables:

1. Time Dimension

- Attributes: Date, Time of Day, Day of the Week, Month, Year, Season, Holiday/Event

2. Menu Items Dimension

- Attributes: Menu Item, Cuisine, Ingredients, Expiration Date, Price, Popularity

3. Customer Dimension

- Attributes: Customer Name, Preferences, Loyalty Status

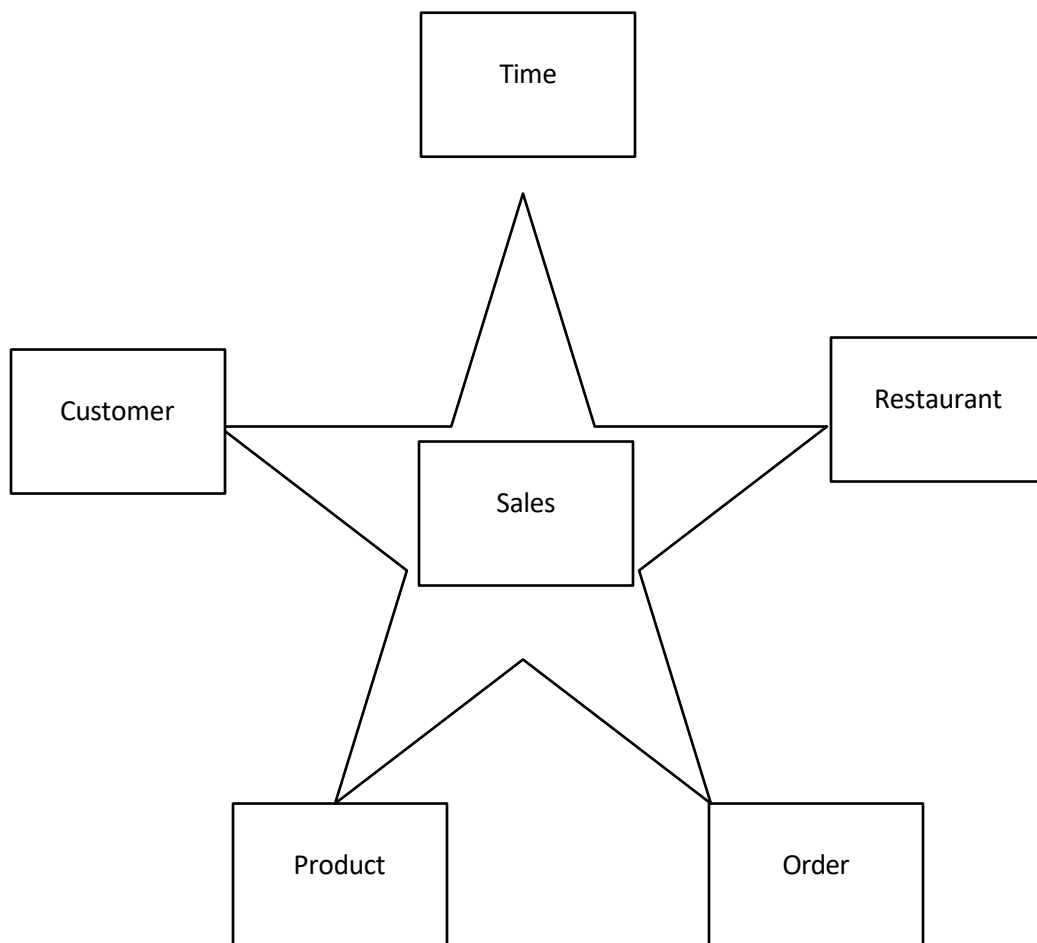
4. **Restaurant Dimension**

- Attributes: Restaurant name, address, phone number

5. **Order Dimension**

- Attributes: Order Number, Order Timestamp, Customer Satisfaction.

STAR SCHEMA:



6) What are the sources of data?

Toast is a POS restaurant-based company, so here we have used a common dataset that has data about more than 10 restaurant and their sales and customer data. It is a collected survey on the New year 2022 which was obtained from the Kaggle website, consisting of two tables with various data fields, including RestaurantID, RestaurantName, Cuisine, Zone, Category, OrderID, Customer Name, Order Date, Quantity of Items, Order Amount, Delivery Time Taken (mins), Customer Rating-Food, and Customer Rating-Delivery. The data preprocessing involved several steps in Excel. Initially, we addressed missing information and empty spaces within the dataset, eliminating any duplicated entries. Additionally, we split details within cells that contained multiple items. Ensuring all data was in the correct format, we checked for evident mistakes and then saved the cleaned dataset as a new file.

7) What is the frequency of the data?

The Toast, Inc. study is predicated on hourly data collection. This implies that the dataset is updated and captured hourly, making it possible to analyze in-depth restaurant operations and customer behavior within designated time periods. A detailed understanding of peak order times, customer preferences, and other trends in time is possible with the hourly data frequency, which also offers insight into the dynamics of restaurant operations throughout the day.

8) What else can you do to help the company achieve their goals?

The POS restaurant-based dataset analysis done on Toast's dataset provides insightful information on a number of operational facets. Initially, a thorough grasp of the kinds of food and eateries that are accessible on the platform has been attained, illuminating the variety of choices that customers have. Analyzing order patterns at peak periods—New Year's Eve, in particular—allows for efficient staffing and resource allocation, which guarantees peak-time performance.

Through the analysis of ratings for meal selections, customer satisfaction has been evaluated, enabling the discovery of popular cuisines and areas in need of improvement. Furthermore, Zone D has the most intersections, according to the Xenographics data, indicating that consumers in this zone, as opposed to Zone B, can enjoy a wide variety of culinary experiences. Strategies to boost sales, cut expenses, improve organizational effectiveness, and improve decision-making ability could be put into practice to further support the company's objectives and guarantee a comprehensive approach to success in the competitive restaurant sector.

The results based on the analyses:

Types of Food and Restaurant: We can find out how many restaurants and types of cuisines are available on Toast, helping us understand the variety of options.

Order Trends: By analyzing the peak order times during New Year, we can figure out the busiest time for restaurant orders. This helps in managing the staff and resource allocations during specific hours.

Customer Satisfaction: Evaluating customer ratings for food choices provides insights into overall customer satisfaction. This results in finding the popular cuisines with the associated star rating helps in recognizing the preference of the customer and areas of improvement.

Results for Xenographics (upset plot): Zone D has the maximum number of intersections, so people who prefer to go to Zone D will be able to experience the maximum number of cuisines they wish to followed by Zone B.

9) Who is/are the consumer(s) of the Business Intelligence insights?

The primary beneficiaries of the business intelligence insights produced by Toast, Inc. would be different organizational stakeholders. This includes executives, managers, and decision-makers

who work in marketing, operations, finance, and strategic planning. Furthermore, these information may help frontline employees, like customer service agents and restaurant managers, make well-informed operational decisions. The ultimate goal is to provide useful knowledge to people in various departments and at different levels so they can use it to make data-driven decisions that are in line with the goals of the organization.

10) **What might you recommend the company do in order to improve their Business Intelligence systems?**

Insights:

Order Trends and Preferences: The analysis revealed peak order times, and popular cuisines, and highlighted specific customer preferences and behaviors.

Customer Satisfaction and Experience: Understanding customer ratings for food and delivery provided insights into areas where the company excels and where improvements might be needed.

Operational Efficiency: Recognizing areas for improvement, such as optimizing pricing strategies and streamlining operations, will enhance the company's effectiveness.

Recommendations:

Tailored Services: Personalizing services based on peak order times and popular cuisines can enhance customer satisfaction and increase sales.

Enhanced Customer Experience: Focusing on areas with lower customer ratings can help improve the overall service quality, boosting customer satisfaction and loyalty.

Optimized Operations: Identifying operational bottlenecks and streamlining processes will improve efficiency, reducing costs and potentially attracting more customers.

Market Adaptability: Remaining adaptable to market changes and leveraging trends in customer

behavior for continuous service enhancement is crucial for long-term success.

Competitive Positioning:

To achieve its objective of becoming a significant participant in the startup restaurant tech sector, Toast must benchmark against competitors in the industry. The organization must routinely evaluate its performance in relation to rivals, utilizing business intelligence instruments to refine tactics, provisions, and deals for a more robust market position.

Zone-based Culinary Experience Enhancement:

With Zone D having the most intersections according to the Xenographics results, Toast can strategically concentrate on improving the dining experience for consumers in this zone. In order to draw more clients to Zone D, this can include adjusting marketing strategies, introducing new cuisines, or partnering with well-known eateries.

Implementing these recommendations will likely result in improved customer satisfaction, increased efficiency, and better adaptability to changing market conditions, leading to sustained growth and profitability for the company in the competitive restaurant tech landscape.

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